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FACTORS RELATED TO ACHIEVEMENT IN JUNIOR HIGH SCHOOL SCIENCE IN DISADVANTAGED AREAS OF NEW YORK CITY.

BY- GIDDINGS, MORSLEY G.

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FACTORS ASSOCIATED WITH ACHIEVEMENT IN SCIENCE BY DISADVANTAGED JUNIOR HIGH SCHOOL STUDENTS ARE IDENTIFIED. STUDENTS WITH IQ SCORES OF 97 OR HIGHER WERE CLASSIFIED AS EITHER SUCCESSFUL OR UNSUCCESSFUL ON THE BASIS OF SCORES FROM A GENERAL SCIENCE TEST. DATA FROM STUDENT INFORMATION SHEETS, INTERVIEWS WITH PARENTS, AND STUDENT CUMULATIVE RECORDS WERE EXAMINED FOR SIGNIFICANT SOCIOECONOMIC BACKGROUND DIFFERENCES BETWEEN THE TWO GROUPS. UNSUCCESSFUL SCIENCE STUDENTS WERE USUALLY MEMBERS OF LARGE FAMILIES, BUT THE PARENTS OF THE STUDENTS IN THE TWO GROUPS DID NOT DIFFER SIGNIFICANTLY IN EDUCATIONAL BACKGROUND OR SOCIOECONOMIC LEVEL. PARENTS OF SUCCESSFUL STUDENTS PROVIDED THEIR CHILDREN WITH MORE READING MATERIALS AND LIVING SPACE CONDUCIVE TO STUDY THAN DID THOSE OF UNSUCCESSFUL STUDENTS. SUCCESSFUL STUDENTS DEVOTED MORE TIME TO THEIR ASSIGNMENTS, HAD A MORE FAVORABLE ATTITUDE TOWARD SCIENCE, AND MADE BETTER SCORES ON OBJECTIVE TESTS IN OTHER ACADEMIC AREAS THAN UNSUCCESSFUL STUDENTS. THIS ARTICLE IS PUBLISHED IN THE "JOURNAL OF RESEARCH IN SCIENCE TEACHING," VOLUME 4, ISSUE 2, 1966. (AG)

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More knowledge about socially disadvantaged students must precede curricular changes designed to help them. This report points up differences between high and low achievers in science who come from similar disadvantaged homes.

Factors Related to Achievement in Junior High School Science in Disadvantaged Areas of New York City

MORSLEY G. GIDDINGS

Center for Urban Education, New York, New York

Introduction

The education of children from disadvantaged areas is now recognized as a matter of national concern. Metropolitan centers and their populations continue to expand at a phenomenal rate. New York City in particular, the largest of these centers in the United States, is confronted with many staggering and complex problems in regard to the education of its disadvantaged youth. New York has a larger number of these youngsters than any other two cities in the United States combined. Its school population is more mobile than that of other cities. Because of the city's housing patterns, the schools are becoming more segregated along racial lines. Moreover, neighborhoods are essentially composed of one social class, and the schools in the slum areas reflect qualitatively and quantitatively the socio-economic position of the neighborhood.

In 1964, there were 264,616 Negro pupils in the New York City school system. This number represented an increase of 91,659 or 53% over the total of 172,957 for 1957–58. Puerto Rican children in the school system in 1964 numbered 177,544, an increase of 48,564 or 37.6% from 1957–58. During this same period, the number of white children enrolled in the public schools *decreased* by 54,324 or 8.3%. A large number of the new Negro and Puerto Rican youngsters came largely from depressed rural areas and, according to all national standards, are disadvantaged.

Because of the population changes in New York City, the number of elementary and junior high schools with a Negro or Puerto Rican enrollment of 85 to 90% has increased sharply. Among elementary schools the number increased from 64 in 1957–58 to 134 in 1964; among junior high schools from 13 to 31. These changes took place during a time when the Board of Education was making efforts to improve the ethnic distribution of children in the public schools and trying to find ways of improving the quality of education for disadvantaged youngsters.

A study based on a representative sample of New York City elementary school children revealed the following mean scores on IQ and reading tests.[1] Sixth grade Puerto Ricans had a mean IQ of 81, Negros, 89; and all other children, 108. Sixth grade Puerto Ricans had a mean reading grade equivalent of 4.4; Negroes, 5.0; and all others, 7.0. Other large cities report very similar results.[2]

Achievement differences between ethnic groups are even greater when one considers the student's sex and date of settlement in New York. Klineberg reported in 1935[3] that IQ's of Negro in-migrant children increased with length of residence in New York City, but that there was a leveling of the effect after five years. In the New York City study by Moriber,[1] indigenous groups had higher IQ and higher reading scores than

in-migrants. The lower the grade at which the newcomer entered, the greater was the difference. The relation of sex difference to academic performance is most pronounced among low-income Negro children and appears to result from the absence of a male model in the family.

There are various efforts currently in operation to help raise the level of achievement among disadvantaged pupils, for example, the Great Cities Project in various cities, the Bannaker District Project in St. Louis, the Amidon School in Washington, D. C., and the Higher Horizons Project in New York City.

These projects have operated on the general theory that the situation called for an expansion of services (such as increased guidance, remedial instruction, individual psychological testing, and counseling) and an increased demand on pupils in terms of higher standards and greater effort. But these projects leave many questions unanswered. For example, there is the important question of why pupils in the same student body (particularly disadvantaged pupils of comparable intellectual ability) who are exposed to the same or similar experiences, reach greatly varying levels of achievement. In short, there is need for an intensive study of the factors related to the disparate school performance of pupils who apparently have adequate intellectual resources for good academic work. A research investigation directed to this problem would be an important initial step in the revision and the preparation of new curricular materials for all students, not only the disadvantaged.

Purpose of the Study

The purpose of the study reported here was to determine the factors associated with varying levels of student achievement in a disadvantaged area of New York City.

Two groups were selected for this investigation. One was called the "high science-achieving or successful group," and the other the "low science-achieving or unsuccessful group." Both were selected from the ninth grade classes at a junior high school in New York City, and both were of comparable intellectual ability (as measured by IQ tests).

The pupils were all Negroes or Puerto Ricans. (The ethnic homogeneity of the school reflects the population pattern of the area in which it is located.)

The study was initiated by making an exploratory survey of the cumulative records of the 500 ninth grade pupils attending the junior high school. The pupils were ranked in order of scores obtained on the Pintner General Ability Test, Intermediate Form B, Verbal. The New York State Survey Test in General Science, Intermediate Form B, was then administered to the top quarter of this group. Those pupils with IQ's of 97 or higher whose scores on the General Science Test were at the seventy-fifth percentile or higher, according to New York State norms, were considered to be comparatively successful. These pupils were grouped together and labeled high science-achievers or successful pupils.

Those pupils with IQ's of 97 or higher whose scores on the General Science Test were at or below the fortieth percentile were considered to be comparatively unsuccessful. These pupils were grouped together and labeled low science achievers or unsuccessful pupils. There were fifteen pupils in each group.

The study investigated eight null hypotheses. These were that high and low achievers in science with similar IQ's do not differ from one another with respect to:

1. The general educational and socio-economic levels of their parents as measured by:
   a. Fathers' formal schooling;
   b. Mothers' formal schooling;
   c. Fathers' socio-economic status;
   d. Mothers' socio-economic status.

2. Their family structure as measured by:
   a. Size of family (number of persons living in home);
   b. Disrupted family pattern, i.e., father missing from the immediate family;
   c. In-migrant parents.

3. The home facilities for, or the interferences with, school work as measured by:

a. The amount of available living space;

b. Places conducive to study;

c. Time spent in the preparation of homework assignments;

d. Contact with books, magazines, etc., in the home.

4. Health problems as measured by the number of illnesses and visits to the clinics.

5. Self-estimates as measured by self-ratings on an inventory of abilities related to:

a. Ability in science;

b. Responsibility;

c. Intellective abilities;

d. Social abilities;

e. Personal and special talents.

6. Attitudes toward science, scientists, and scientific careers as measured by:

a. Interest in science and in becoming a scientist;

b. Reasons for interest or disinterest in becoming a scientist;

c. Girls' view of science;

d. Experiences with scientists;

e. Selection of an occupation in science and science-related areas;

f. Attainment of occupational goals.

7. Attitudes toward and behavior in school as measured by:

a. Junior high school subject liked best;

b. Junior high school subject liked least;

c. Attendance at school;

d. Grade point averages;

e. Participation in extracurricular activities in science;

f. Infractions of school regulations.

8. Achievement in academic subject matter areas other than science as measured by standardized and citywide tests.

To test these hypotheses, information was secured from the cumulative records and the official school records for each pupil in the study. A Student Information Sheet was also devised and administered to both groups. This instrument was used to explore the educational, social, cultural, experiential, and aspirational background of the pupils comprising the two groups. (The informational sheet was administered by this investigator in a face-to-face situation with each pupil.)

The method of analysis was mainly one of studying and interpreting the cumulative records, the official records, and the responses obtained from the information sheet. Standard statistical procedures were used to determine whether or not there were significant differences between the two groups and to identify the factors which may be associated with achievement in science. In all the comparisons made, the 0.05 level of significance was the lowest limit at which the differences were considered to be significant.

The varying aspects of the null hypotheses tested were either wholly or partially confirmed by the data as follows:

1. There were only minimal differences between the high and low science-achievers in regard to the general educational and socio-economic levels of their parents. Most of the mothers (23 of 30) had some high school education. Twenty of thirty fathers had elementary school education. Most of the employed parents (39 of 42) were engaged in jobs on the lowest rung of the socio-economic scale. Therefore, on the basis of the data, null hypothesis 1 was accepted.

2. It was found that the low science-achievers tended to come from larger families (more than 5 persons) than the high science-achievers. There were, however, only minimal differences between the groups in terms of disrupted family patterns, i.e., father away from the immediate family, and parents who were in-migrants to New York City. Therefore, on the basis of the data, null hypothesis 2 was partially rejected.

3. There was a significant difference between the two groups in terms of: the amount of available living space, degree of contact with books and magazines found in the home, time spent in the preparation of homework assignments, and places in the homes which were conducive to study.

Therefore, on the basis of the data, null hypothesis 3 was rejected.

Many of the books which were included in the count were textbooks on loan to pupils from the public schools or public libraries. Seven parents of the high science-achievers subscribed to *Life* magazine, five to *Jet*, four to *Ebony* and nine to *Science Digest*. This last magazine was an assigned reading by the science teacher. No parent of the low science-achievers subscribed to *Life;* however, three did subscribe to *Ebony*, one to *Jet*, two to *McCalls*, and three to *Science Digest*. In the assessment of the data and in the course of home visits, a low level of interest in reading and a low level of reading habits were very apparent. For example, more than 50% of the parents had never belonged to a public or private lending library.

Some of the homes showed no evidence of books and magazines other than the textbooks from the public schools or the public library, and in many instances these were neatly tucked away in a closet. The only evidence of reading material in these homes was the daily racing form, a few comic books, and a tabloid newspaper. In a total of 25% of the homes, parents indicated they only read parts of the newspapers and the racing results of the previous day.

Significantly enough, there was a greater number of library cards, a greater participation in the use of library facilities, and a greater interest in reading and other educational activities generally among the parents and pupils of the high science-achievers. Since the general reading habits of parents are very likely to influence the reading interests and verbal development of their children (and, consequently, the child's attainment in school), it may be assumed that parental interest and motivation had encouraged the high science-achiever to a greater degree than occurred in the case of the low science-achiever.

The difference in time spent on homework assignments is a real one and can account, in part, for the high science-achieving pupil's better preparation of lessons and his generally superior performance.

4. There were only minimal differences between the high and low science-achievers in the number of illnesses, or in the clinics they visited. All thirty pupils comprising the two groups indicated that, in the past, they had suffered from mumps, measles, and chicken pox. There were just as many individuals in the high as in the low science-achieving group attending the eye, dental, social agency, speech, nutritional, hospital, mental hygiene, and orthopedic clinics. Therefore, on the basis of the data, null hypothesis 4 was accepted.

5. There was some difference between the high and low science-achieving groups in the levels of their self estimate. Interestingly enough there was a significant difference between the groups in the categories of responsibility, ability in science, and intellective abilities. This differential was unfavorable to the low science-achieving group. It should be remembered in this regard that one of the criteria for the selection of pupils was comparable scores on a test of general ability. In the categories of social abilities, personal and special talents, and on the total score for all the items of the inventory, only minimal differences existed between the groups.

If we can accept the ratings of the high science-achieving group on the five categories of the ability-rating inventory as objective evidence of levels of self estimate—and nothing in the data opposes such an interpretation—there is a significant difference between the groups on some aspects of their levels of self estimate (responsibility, intellective abilities, and ability in science). Null hypothesis 5 was, therefore, partially rejected.

6. There was a significant difference between high and low science-achievers in terms of their interest in science and in becoming a scientist, and in regard to their selection of an occupation in science and science-related areas. All pupils in the

groups expected to attain their occupational goals. None of the pupils had firsthand experiences with scientists. The girls viewed science very favorably. There were, however, minimal differences in attitudes toward science, scientists, and scientific careers.

The data obtained from the attitude inventory indicated that in all categories the high science-achievers answered more questions which indicated a favorable attitude toward science than did the low science-achievers. This trend was particularly noticeable in the categories dealing with the impact of science on society, characteristics of a scientist, and the effectiveness of science teaching in the school.

7. There was a difference between the high and low science-achieving groups in the junior high subjects liked best and least liked, in attendance and punctuality at school, in grade point averages, in deportment (conduct), and in participation in extracurricular activities. Absences and latenesses cannot by themselves explain low achievement. Therefore, on the basis of this data, null hypothesis 7 was rejected.

8. There was a difference between the high and low science-achieving groups in scores on objective tests in academic areas other than science. Scores on citywide tests in English, foreign language, and social studies, and standardized tests in mathematics were used for this comparison. In English, foreign language, mathematics, and social studies, there was a statistically significant difference between the mean achievement scores of the groups, and this difference was in favor of the high science-achiever.

Conclusions

This investigation did not highlight all the factors related to low and high achievement in science. For example, personality factors *per se* as they relate to such achievement were not investigated. Rather, the study examined sociological, familial, environmental, and economic factors as they affect the science achievement of children with backgrounds in disadvantaged urban areas.

The interpretation of the data by this investigator does seem to suggest, however, that in addition to the factors mentioned, there were several others which served to distinguish between the groups of low and high achievers. Throughout the interviews and other contacts with the investigator, whose judgment was supported by other teachers, the high science-achievers indicated that they were a superior group. The majority of them were able to communicate verbally much more efficiently than their peers in the low science-achieving group. The high achievers showed the same superiority in written assignments.

Further, all the pupils in the high science-achieving group were members of and participated in the activities of two or more extra curricular science clubs. These youngsters had the opportunity to use the methodology and tools of science. They also had the added opportunity of visiting laboratories and observing machines and technicians at work. These opportunities were also available to the low science-achievers. But, they rarely took advantage of them.

If the findings of this study constitute an accurate portrait of high science-achievers, then the comparative adjustment of these youngsters must be explained by factors which stimulate achievement in the face of inadequacies. All the children involved in the two groups were confronted with the same or similar academic experiences. Their environmental situations were also quite similar. In short, while there were differences between the groups, the similarities outweighed the differences. From an analysis of the data it seems reasonable to suggest that the following factors contributed to achievement in science.

1. Interest and encouragement by parents. Such interest was indicated by the parents during the investigators' home visits and in the parents' own visits to school. Some parents indicated that they had secured educational insurance policies to help their children go into higher education. Others indicated that they were prepared to secure

education loans from appropriate agencies or secure additional jobs to help their children go through college. Three parents of high science-achievers had secured scholarship information, which they then passed on to their children. Conceivably, such interest and encouragement had an important, motivating impact on the children.

2. The use of cultural facilities for the preparation of homework. The high science-achieving group, much more often than the low achieving group, were given permission by their parents to visit libraries and museums. Some parents periodically accompanied their children on these visits.

3. A place which was conducive to study, and free from emotional tensions and disturbances. The data indicated a significant difference in available room space between the groups in favor of the high science-achievers. Many of the low science-achievers did not have a place which was conducive to study. In some homes which had available room space, the space was rented. The difference in the living conditions of the two groups does not necessarily mean that the school achievement of the minister's nine children would inevitably suffer because the family of eleven occupied a five-room apartment. Of course, this may happen. However, the difference does suggest that of two children of the same or similar intelligence, from the same or similar sized family, the one coming from the less crowded home would generally tend to perform better in his school work.

4. Interest in science and scientific careers. This interest was enhanced by encouragement and promises of financial assistance from parents to help their pupils realize their vocational and aspirational goals.

5. Differences between groups as to their levels of self estimate. The differences between the groups as to their self estimates were not significant when computed on total scores (the sum of responses in the five different areas of the attitude inventory). However, when the differences were examined separately in each of five areas, (*a*) responsibility, (*b*) ability in science, (*c*) general ability, (*d*) social rating, and (*e*) other responses, significant differences were found on scores in the first three. This finding might help account for the superiority of the high science-achievers in academic areas, in general.

A realistic self estimate is especially important for disadvantaged children. There is a need for these youngsters to have successful experiences. Such experiences will help increase their self respect, and will also indicate to them that they, too, can have opportunities to experience success. This, in turn, will help increase their motivation for academic achievement.

It is believed that the present study serves its most useful purpose by indicating an important area for research. Hopefully, the study will lead to further investigation. Only by systematic and carefully controlled research efforts can we accumulate sufficient evidence to plan adequate programs for disadvantaged pupils.

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